

10780995

Application No.: 10/789,995
Date of Amendment: March 27, 2006
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IN THE CLAIMS:

1-15. Canceled.

16. (Currently Amended) The method of claim 2 19 wherein the hydrophobically modified water-soluble polymer has a molecular weight in the range of from about 100,000 to about 10,000,000.

17-18. Canceled.

19. (Currently Amended) A method of reducing the permeability of one or more selected sections of a subterranean formation penetrated of a horizontal well bore and the flow of water or water and hydrocarbons or hydrocarbons therefrom comprising the steps of:

(a) preparing or providing an aqueous treating fluid comprising water and a water-soluble formation permeability reducing agent, wherein the water-soluble formation permeability reducing agent is a hydrophobically modified water-soluble polymer present in the aqueous treating fluid in an amount in the range of from about 0.1% to about 10% by weight of the aqueous treating fluid, wherein the hydrophobically modified water-soluble polymer is a reaction product of a hydrophilic monomer and a hydrophobically modified hydrophilic monomer, and The method of claim 18 wherein the hydrophobically modified water-soluble polymer comprises a dimethylaminoethyl methacrylate/hexadecyldimethylammoniumethyl methacrylate bromide copolymer having a mole ratio of hydrophilic monomer to hydrophobically modified hydrophilic monomer of 95:5; and

(b) introducing the aqueous treating fluid containing the water-soluble formation permeability reducing agent into the one or more selected sections of the subterranean formation closest to the heel of the horizontal wellbore so that the permeabilities and flows of water or water and hydrocarbons or hydrocarbons therefrom are reduced.

20-21. Canceled.

10780995

Application No.: 10780995
Date of Amendment: March 27, 2006
Date Office Action Mailed: January 27, 2006

22. (Currently Amended) The method of claim ~~24~~ 33 wherein the hydrophilic reactive polymer comprises a reactive amino group.

23. (Currently Amended) The method of claim ~~24~~ 33 wherein the hydrophilic reactive polymer is a product of a polymerization reaction in which at least one monomer is selected from the group consisting of dimethylaminoethyl methacrylate and dimethylaminopropyl methacrylamide.

24. (Currently Amended) The method of claim ~~24~~ 33 wherein the hydrophilic reactive polymer is selected from the group consisting of polyethyleneimine, polyvinylamine, poly(vinylamine/vinyl alcohol), chitosan and polylysine.

25. (Currently Amended) The method of claim ~~24~~ 33 wherein the hydrophilic reactive polymer comprises an alkyl acrylate polymer.

26. (Original) The method of claim 25 wherein the alkyl acrylate polymer is selected from the group consisting of polydimethylaminoethyl methacrylate, polydimethylaminopropyl methacrylamide, poly(acrylamide/dimethylaminoethyl methacrylate), poly(acrylamide/dimethylaminopropyl methacrylamide) and poly(acrylic acid/dimethylaminoethyl methacrylate).

27. (Currently Amended) The method of claim ~~24~~ 33 wherein the hydrophilic reactive polymer is a reaction product of a hydrophilic monomer copolymerized with monomers containing reactive amino groups.

28. (Original) The method of claim 27 wherein the hydrophilic monomer is selected from the group consisting of acrylamide, 2-acrylamido-2-methyl propane sulfonic acid, N,N-dimethylacrylamide, vinyl pyrrolidone, acrylic acid, trimethylammoniumethyl methacrylate chloride, methacrylamide and hydroxyethyl acrylate.

29-30. Canceled.

10780995

Application No.: 10780995
Date of Amendment: March 27, 2006
Date Office Action Mailed: January 27, 2006

31. (Currently Amended) A method of reducing the permeability of one or more selected sections of a subterranean formation penetrated of a horizontal well bore and the flow of water or water and hydrocarbons or hydrocarbons therefrom comprising the steps of:

(a) preparing or providing an aqueous treating fluid comprising water and a water-soluble formation permeability reducing agent, wherein the water-soluble formation permeability reducing agent is a hydrophilically modified water-soluble present in the aqueous treating fluid in an amount in the range of from about 0.1% to about 10% by weight of the aqueous treating fluid, wherein the hydrophilically modified water-soluble polymer is a reaction product of a hydrophilic reactive polymer and a hydrophilic compound, wherein the hydrophilic compound is selected from the group consisting of halogen containing polyethers, and The method of claim 29 wherein the halogen containing polyether comprises an epichlorohydrin terminated polyethylene glycol methyl ether; and

(b) introducing the aqueous treating fluid containing the water-soluble formation permeability reducing agent into the one or more selected sections of the subterranean formation closest to the heel of the horizontal wellbore so that the permeabilities and flows of water or water and hydrocarbons or hydrocarbons therefrom are reduced.

32. (Currently Amended) The method of claim 29 ~~33~~ wherein the hydrophilically modified water-soluble polymer comprises a polymer having a molecular weight in the range of from about 100,000 to about 10,000,000.

10780995

Application No.: 10789995
Date of Amendment: March 27, 2006
Date Office Action Mailed: January 27, 2006

33. (Currently Amended) A method of reducing the permeability of one or more selected sections of a subterranean formation penetrated of a horizontal well bore and the flow of water or water and hydrocarbons or hydrocarbons therefrom comprising the steps of:

(a) preparing or providing an aqueous treating fluid comprising water and a water-soluble formation permeability reducing agent, wherein the water-soluble formation permeability reducing agent is a hydrophilically modified water-soluble present in the aqueous treating fluid in an amount in the range of from about 0.1% to about 10% by weight of the aqueous treating fluid, wherein the hydrophilically modified water-soluble polymer is a reaction product of a hydrophilic reactive polymer and a hydrophilic compound, wherein the hydrophilic compound is selected from the group consisting of halogen containing polyethers, and ~~The method of claim 29~~ wherein the weight ratio of the hydrophilic reactive polymer to the halogen containing polyether is in the range of from about 1:1 to about 10:1; and

(b) introducing the aqueous treating fluid containing the water-soluble formation permeability reducing agent into the one or more selected sections of the subterranean formation closest to the heel of the horizontal wellbore so that the permeabilities and flows of water or water and hydrocarbons or hydrocarbons therefrom are reduced.

10780995
Application No.: 10/289,995
Date of Amendment: March 27, 2006
Date Office Action Mailed: January 27, 2006

34. (Currently Amended) A method of reducing the permeability of one or more selected sections of a subterranean formation penetrated of a horizontal well bore and the flow of water or water and hydrocarbons or hydrocarbons therefrom comprising the steps of:

(a) preparing or providing an aqueous treating fluid comprising water and a water-soluble formation permeability reducing agent, wherein the water-soluble formation permeability reducing agent is a hydrophilically modified water-soluble present in the aqueous treating fluid in an amount in the range of from about 0.1% to about 10% by weight of the aqueous treating fluid, wherein the hydrophilically modified water-soluble polymer is a reaction product of a hydrophilic reactive polymer and a hydrophilic compound, and The method of claim 21 wherein the hydrophilically modified water-soluble polymer is selected from the group consisting of the reaction product of polydimethylaminoethyl methacrylate with epichlorohydrin terminated polyethylene glycol methyl ether, the reaction product of poly(acrylamide/dimethylaminoethyl methacrylate) with epichlorohydrin terminated polyethylene glycol methyl ether, the reaction product of polydimethylaminopropyl methacrylamide with epichlorohydrin terminated polyethylene glycol methyl ether, and the reaction product of poly(acrylamide/dimethylaminopropyl methacrylamide) with epichlorohydrin terminated polyethylene glycol methyl ether; and

(b) introducing the aqueous treating fluid containing the water-soluble formation permeability reducing agent into the one or more selected sections of the subterranean formation closest to the heel of the horizontal wellbore so that the permeabilities and flows of water or water and hydrocarbons or hydrocarbons therefrom are reduced.

35 - 43. Canceled.

44. (Currently Amended) The method of claim 19 wherein the aqueous treating fluid further comprises a gelling agent.

45. Canceled.

10780995

Application No.: 10/789,995
Date of Amendment: March 27, 2006
Date Office Action Mailed: January 27, 2006

46. (Currently Amended) ~~A method of temporarily reducing the permeability of one or more selected sections of a subterranean formation penetrated by a horizontal well bore and the flow of water or water and hydrocarbons or hydrocarbons therefrom and restoring the permeability and flow when required comprising the steps of:~~

~~(a) — preparing or providing an aqueous treating fluid comprising water and a water-soluble formation permeability-reducing agent selected from the group consisting of a hydrophobically-modified water-soluble polymer, a hydrophilically-modified water-soluble polymer and a hydrophobically-modified water-soluble polymer comprising polar heteroatoms within the polymer backbone;~~

~~(b) — introducing the first aqueous treating fluid containing the water-soluble formation permeability-reducing agent into the one or more selected sections of the subterranean formation closest to the heel of the horizontal wellbore so that the permeabilities and flows of water or water and hydrocarbons or hydrocarbons therefrom are reduced; and~~

~~(c) — The method according to claim 19, further comprising the step of:~~
when required, contacting said one or more selected sections with a second aqueous treating fluid comprising water and a formation permeability restoring chemical.

47-90. Canceled.

91. (Original) The method of claim 46 wherein the formation permeability restoring chemical in the second aqueous treating fluid is selected from the group consisting of alkali, alkaline earth and transition metal salts of periodate, hypochlorite, perbromate, chlorite, chlorate, hydrogen peroxide, peracetic acid, soluble peroxide salts, persulfate salts, percarboxylate acids, oxyhalo acids and mixtures thereof.

92. (Original) The method of claim 91 wherein the permeability restoring chemical is sodium hypochlorite.

93. (Original) The method of claim 91 wherein the permeability restoring chemical is present in the second aqueous treating fluid in an amount in the range of from about 1% to about 25% by weight of the second aqueous treating fluid.

RESPONSE TO FINAL OFFICE ACTION OF JANUARY 27, 2006 - Page 7

10780995
Application No.: 10/780995
Date of Amendment: March 27, 2006
Date Office Action Mailed: January 27, 2006

94. Canceled.

95. (Currently Amended) The method of claim ~~21~~ 33 wherein the hydrophilic reactive polymer is chitosan.

96. Canceled.